Environment CANADA Environnement
20229931 VOL 85- ISS 11 851000
EXC # 001
TD 171.5.C3 R43
REGIONAL PROGRAM REPORT (CANADA. EN
VIRONMENTAL PROTECTION SERVICE. PAC
OOFF

Environment Canada

Environnement Canada

Environmental Protection Service

Service de la protection de l'environnement

DEPARTMENT OF THE ENVIRONMENT
ENVIRONMENTAL PROTECTION SERVICE
PACIFIC REGION

# A REVIEW OF THE SURFACE FINISHING INDUSTRY IN BRITISH COLUMBIA

Regional Program Report No. 85-11

By

W. Bailey

October 1985

## ABSTRACT

In 1984 a study of the surface finishing industry in British Columbia was conducted to determine the size and nature of the industry and to identify potential environmental problems. The report presents the results of a provincial survey which covered surface finishing process operations, solid and liquid waste generation, treatment and disposal, and the recovery and recycling of wastes. There are an estimated 70 to 75 surface finishers in British Columbia; sixty-two completed and returned the survey questionnaire. Although the questionnaire did not cover air emissions and emission control technology, this information was gathered later for a number of major plants.

Much of the solid and liquid waste from the surface finishing industry may be considered as potentially hazardous since metals and organic solvents are frequent components. In British Columbia a very high proportion of companies with a positive liquid discharge have some form of treatment in place (95%). However, a relatively low percentage of companies with hazardous wastes (i.e. oil, solvent, paint, process sludges) treat or recycle these wastes (41%). Furthermore, many of the companies sending waste for off-site disposal could not identify the disposal site, and many sent the waste through the municipal garbage system.

Air emission control is widely practised amongst larger size companies; it is not known to what extent treatment of air emissions is undertaken at smaller companies.

## RÉSUMÉ

En 1984, une étude de l'industrie de traitement de surface en Colombie-Britannique fut conduite afin de déterminer la dimension et la nature de l'industrie ainsi qu'identifier le potentiel des problèmes environnementaux. Ce rapport présente les résultats de l'étude provinciale laquelle couvre les opérations de procédé de traitement de surface, la génération de déchets solides et liquides, le traitement et l'élimination, de même que la récupération et le recyclage des déchets. On estime qu'il y a de 70 à 75 "traiteurs de surface" en Colombie-Britannique; soixante-deux ont complété et retourné le questionnaire de l'étude. Quoique le questionnaire n'a pas traité les émissions atmosphériques et les systèmes de traitement, ces renseignements furent ramasées par la suite pour quatorze de ces compagnies.

La majorité des déchets solides et liquides de l'industrie de traitement de surface peuvent être considérés comme potentiellement dangereux, puisque les métaux et les solvants organiques sont des composants fréquent. En Colombie-Britannique, une proportion très élevé de compagnies avec une décharge liquide positive a une forme de traitement en place (95%). Cependant, une basse proportion de compagnies avec des déchets dangereux "spéciaux" (i.e. huile, solvant, peinture, boues de procédé) ont traité ou recyclé les déchets (41%). De plus, plusieurs de ces compagnies envoyant leur déchets à l'extérieur pour élimination n'ont pu identifier le site d'élimination, et plusieurs envoyent leurs déchets au site d'enfouissement municipal.

Un nombre élevé d'instruments de contrôle de pollution sont employés pour le traitement des émissions atmosphériques par les compagniés où l'information était disponible. Cependant, ce sont les plus importantes compagnies; l'étendue du traitement des émissions atmosphériques entrepris par les petites compagnies n'est pas connue.

## TABLE OF CONTENTS


| | | Page |
|---|---|---|
| ABSTRACT | | i |
| RÉSUMÉ | | ii |
| TABLE OF CONTENTS | | iii |
| | List of Figures | v |
| | List of Tables | vi |
| 1 | INTRODUCTION | 1 |
| 2 | PROCESS OPERATIONS PROFILE | 2 |
| 2.1 | Classification According to Size | 2 |
| 2.2 | Breakdown According to Process | 2 |
| 2.3 | Location | 4 |
| 2.4 | Turnover | 4 |
| 3 | LIQUID RATES AND DISCHARGES | 7 |
| 3.1 | Spent Process Solutions | 7 |
| 3.2 | Water Reduction Facilities | 7 |
| 3.3 | Liquid Effluent | 7 |
| 4 | SPECIAL WASTES | 10 |
| 4.1 | Solvent and Oil Wastes | 10 |
| 4.2 | Paint Wastes | 11 |
| 4.3 | Additional Sludges | 12 |
| 4.4 | Recovery/Recycling | 13 |
| 5 | ATMOSPHERIC EMISSIONS | 14 |
| 5.1 | Types of Emissions | 14 |
| 5.2 | Pollution Control Systems | 15 |

TABLE OF CONTENTS (Continued)


| | | Page |
|---|---|---|
| 6 | CONCLUSIONS | 16 |
| BIBLIOGRAPHY | | 26 |
| APPENDIX A | LIST OF SURFACE FINISHING COMPANIES IN BRITISH COLUMBIA | 27 |
| APPENDIX B | QUESTIONNAIRE USED IN THE SURVEY | 32 |
| APPENDIX C | OVERVIEW OF EMISSIONS DATA FOR THE SURFACE FINISHING INDUSTRY IN BRITISH COLUMBIA | 42 |
| APPENDIX D | LIST OF WASTE GENERATED BY THE SURFACE FINISHING INDUSTRY | 50 |

## LIST OF FIGURES


| Figure | | Page |
|---|---|---|
| 1 | LOCATION OF SURFACE FINISHING COMPANIES IN B.C. | 5 |
| 2 | LOCATION OF SURFACE FINISHING COMPANIES IN LOWER MAINLAND | 6 |

## LIST OF TABLES


| Table | | Page |
|---|---|---|
| 1 | SURFACE FINISHING INDUSTRY BREAKDOWN | 19 |
| 2 | PROCESS OPERATIONS USED BY SURFACE FINISHING INDUSTRIES | 20 |
| 3 | LOCATION OF SURFACE FINISHING INDUSTRIES IN B.C. | 21 |
| 4 | LIQUID EFFLUENT - DISCHARGE AND QUALITY DETAILS | 22 |
| 5 | LIQUID EFFLUENT - TREATMENT AND COLLECTION DETAILS | 23 |
| 6 | WASTE OIL/SOLVENT/SLUDGE STREAM DISPOSAL | 24 |
| 7 | RECORD OF AIR EMISSIONS | 25 |

# 1 INTRODUCTION

A review of the surface finishing industry in British Columbia was carried out in 1984 using a mail-out questionnaire. This survey was part of a cross Canada survey initiated by the Industrial Programmes Branch of the Environmental Protection Service in Ottawa as early as 1982. The questionnaire was designed by the Industrial Programmes Branch and results from across Canada are expected to be published in 1985. This report however summarizes the findings for the province of British Columbia only.

Information was requested on the type of surface finishing operations used, the treatment and discharge of spent process solutions and liquid effluent streams, and the treatment and disposal of sludges and wastes. In all, 376 companies were contacted, replies were obtained from 332 (eighty-eight percent), and of those 62 were identified as belonging to the surface finishing industry. For the purposes of data correlation, these sixty-two companies were divided into three categories relating to the size of the company with respect to the surface finishing portion of its operations.

To compliment the information gathered in the survey, atmospheric emissions data was subsequently obtained from regional air permits, federal files and site visits. Information was available for fourteen surface finishers.

This report is organized into four sections describing: (1) process operations, (2) liquid wastes, (3) special wastes, and (4) air emissions. Tables are attached at the back of the report. A list of the British Columbian surface finishers appears in Appendix A, while the questionnaire used to establish the data base appears in Appendix B.

## 2 PROCESS OPERATIONS PROFILE

Surface finishing consists of various chemical, electrolytic and physical processes which change the surface of a product to enhance its appearance, increase its corrosion resistance, or produce surface characteristics essential for subsequent operations.

Sixty-two of 332 survey respondents were identified as belonging to the surface finishing category. A general profile of the companies and their operations has been prepared from the survey material.

### 2.1 Classification According to Size

Companies were classified as being small, medium or large depending on such criteria as dollar value of surface finished products, number of employees actually employed in surface finishing and if necessary, other information such as amount of solvent used. The criteria for each category were arbitrarily set as follows: a "small" company employed from one part-time to four full-time employees and had earnings of less than one hundred thousand dollars, a "medium" size company employed from two to ten employees and had earnings of less than one million dollars, and a "large" size company usually employed ten or more and had earnings of over one million dollars. Using these criteria seventeen companies were identified as being large, thirty as being of medium size and fifteen were identified as small. These divisions were useful for evaluating trends, for example, companies more likely to recycle or reclaim.

### 2.2 Breakdown According to Process

Companies were further classified according to the type of product manufactured or service supplied. The most common types of surface finishing industries were electroplating services (20), followed by fabricated metal products (14), primary metal products (11), and transportation equipment manufacture and repair (6). Other classifications were specialized metal finishing services (5), electronic and electrical equipment

(3), machinery equipment (2), and miscellaneous products (1). Table 1 lists the industry classification, the number of companies in each, and breaks the numbers down according to size. Large companies are predominant in primary metal products, and in the manufacture and repair of transportation equipment for airplanes and ships. Medium size companies made up most of the electroplating industry and fabricated metal products, while the small companies were very diverse.

Surface finishers were asked to identify which of twenty process operations were employed at the company. The most common were alkaline cleaning, electroplating, and solvent cleaning which are each used by roughly half of the companies. Approximately one third used mechanical deburring or sandblasting, acid pickling, coating (painting or plastic), and stripping electrodeposits, while chemical conversion coating and quenching from metal heat treating were done by about one quarter of the surface finishers. Table 2 lists the process operations used by the surface finishing industry.

Since electroplating is the most widely used process operation and involves the use of diverse metal plating solutions, the types of plating and solutions used will be briefly discussed here. Chrome plate, the most common type of plating was done at twenty-one companies; all but one used an acid bath solution. Nickel plate was done at sixteen companies; fourteen of these used nickel bright plating solutions. Sixteen companies did copper plating where the copper cyanide process was the most common. Ten companies did brass plating, six did gold plating, and six did silver plating. Cadmium plating was done in cyanide solution at five companies, while zinc plating was done at four companies with two using a zinc cyanide bath and two using a zinc chloride bath. Other types of plating done in British Columbia include tin, tin/lead, rhodium, iron and lead.

Irrespective of the operations used, surface finishing companies can be divided into two basic categories, that is, captive shops and job or contract shops. Captive shops serve only one client and are often

integrated within large manufacturing operations. Job shops normally specialize in one or two types of surace finishing and provide services to numerous customers. In British Columbia, forty companies were identified as captive and 22 were identified as job shops.

## 2.3 Location

Forty-eight companies or seventy-seven percent of the surface finishing industries are situated in the Lower Mainland, with greatest number being in Vancouver (31%) and then Richmond (13%). The remainder of the British Columbian surface finishers are equally divided amongst various locations in the Interior (7 companies or 11%) and Vancouver Island (7 companies or 11%). Figures 1 and 2 shows the locations of the companies in B.C. and the Lower Mainland. Table 3 provides a breakdown according to size and location.

## 2.4 Turnover

Forty-four companies or seventy-one percent have been in business for ten years or more. Six companies have been in business between six and ten years, while twelve have been in business five years or less. Larger companies were more apt to have been around a long time; all were ten years old or more.

The turnover rate is thus very high, with one third of the companies being in business for less than 10 years. The newer companies are small and medium in size.

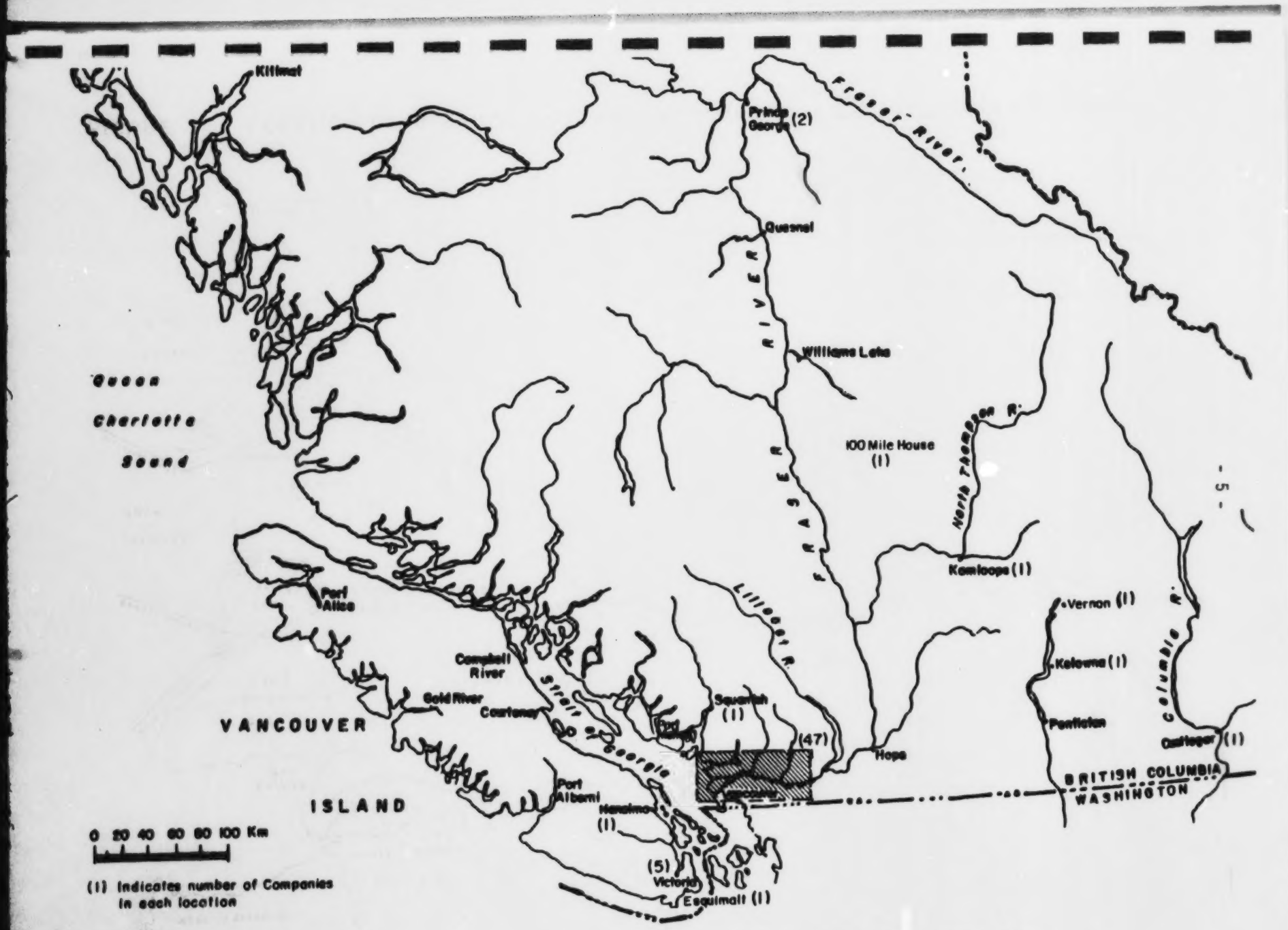


FIGURE 1 LOCATION OF SURFACE FINISHING COMPANIES IN BRITISH COLUMBIA

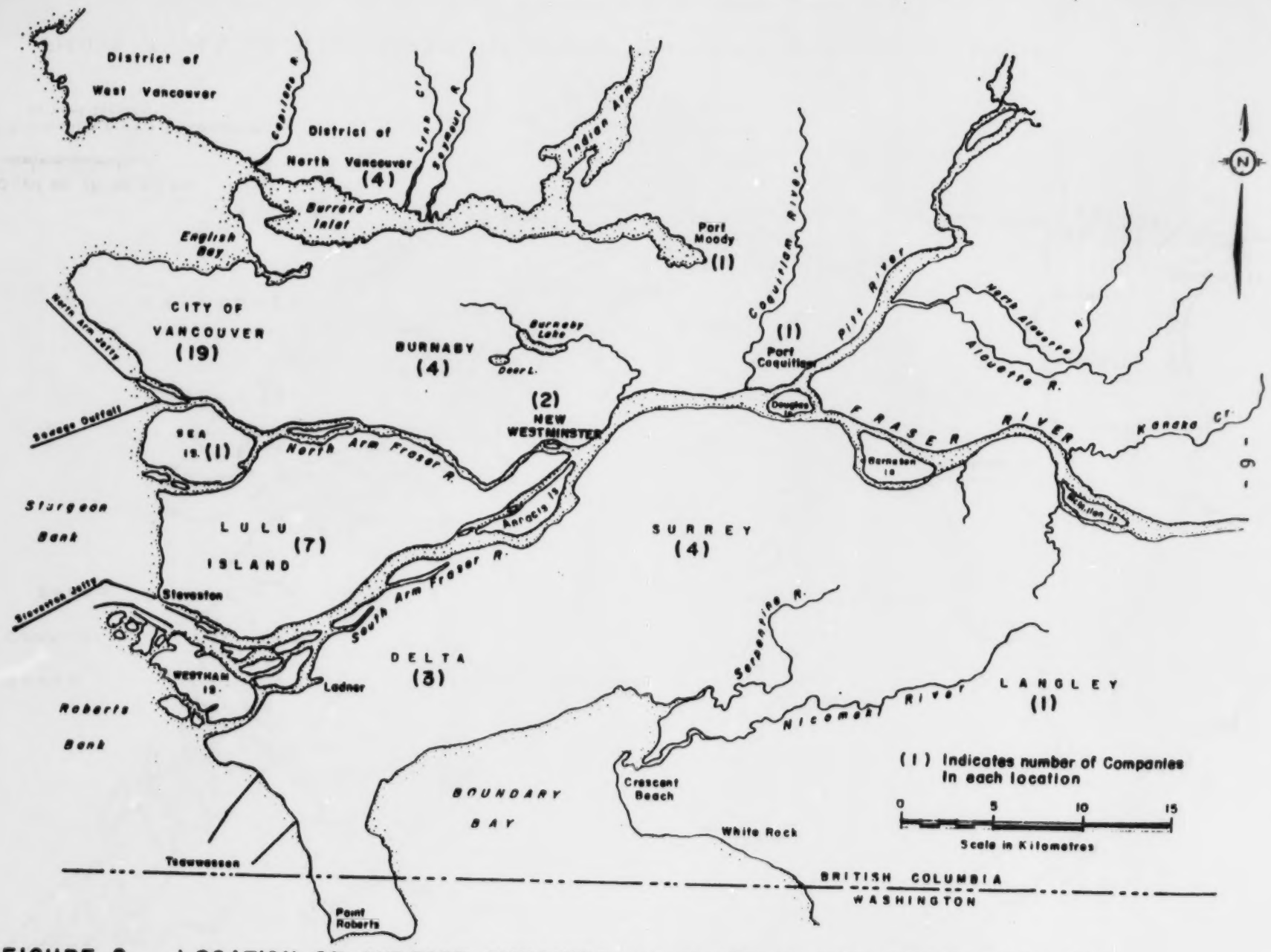


FIGURE 2 LOCATION OF SURFACE FINISHING COMPANIES IN THE LOWER MAINLAND

# 3 LIQUID WASTES AND DISCHARGES

Information was requested about liquid wastes and discharges, more particularly concerning the fate of spent process solutions, existence of water reduction facilities, collection, treatment and discharge of liquid effluent, and also effluent monitoring and quality.

## 3.1 Spent Process Solutions

In the surface finishing industry, spent process solutions represent the most contaminated souce to the liquid effluent discharge. Thirty-five companies stated that they did treat the spent process solutions, with neutralization being the most common method, used by twenty companies. Other methods included settling, reduction and oxidation. Spent process solutions, pretreated or otherwise were discharged in most cases to an effluent treatment system (twenty-three companies) or to the sewer (fourteen companies). However, a few companies sold the solutions for use, or had them picked up for recycle.

## 3.2 Water Reduction Facilities

Water reduction facilities are used by industry to keep water use, especially process water use to a minimum. Thirty-two companies (fifty percent) reported having water reduction facilities of one kind or another. The most common types were spray rinsing, delay over rinse tanks to reduce drag out, and holding tanks or dams. These were each installed at two-thirds of the companies which had water reduction systems. Nearly half of the companies in the same category used counter-flow rinsing, effluent segregation and minimization of seepage loss methods. Conductivity metres were used only by the large companies.

In addition three companies had installed total recycle systems.

## 3.3 Liquid Effluent

Various questions were asked about liquid effluent, such whether there was any, if it was treated, the nature of the treatment, where it was

discharged and if it was monitored and by whom. Of the sixty-two surface finishers, thirty seven acknowledged a positive discharge, three had a closed loop recycling system (and therefore no discharge) and twenty-two stated they had no liquid effluent. Thirty-five had effluent treatment systems; twenty-four of these had one person responsible for the system. Thirteen companies thought they could estimate the annual cost of compliance with control requirements, although only three specified amounts. A medium size electroplating service estimated that compliance cost $800 annually for chromic acid reduction. A large transport sector company estimated that compliance cost $5,000; treatment consisted of acid or base neutralization, reduction of chromic acid and disposal of sludges. Another large company volunteering the annual compliance cost estimated it to be $100,000. This company produced fabricated metal products and treatment involved clarification/gravity settling acid, and base neutralization, chromic acid reduction, chlorination, sludge formation/high pressure filtration, and recycling of oil and solvent wastes.

Amongst the seventeen larger companies, eleven had positive liquid discharge; all eleven had treatment systems in place, and in all cases the effluent had been monitored. Monitoring was done in most cases by the companies themselves, however regulatory agencies at multiple levels tended to monitor these companies, putting a high priority on them compared to smaller industries. Monitoring results were supplied by all large companies except one. Two additional companies had closed loop water systems.

Twenty-one of the thirty medium size companies had a positive liquid discharge, and twenty of these had treatment systems. Sixteen of these had had their effluent monitored, usually by the municipality (in nine cases). Occasionally the company had monitored the effluent on its own (in seven cases). Only a few results were supplied. One company had a closed loop system.

Five of the smaller industries had positive liquid discharge; four had treatment systems. These same four had had the effluent monitored, however only once by a regulatory agency. Due to the small size

of these companies, monitoring of the effluent is not a priority for the pertinent regulatory agencies.

Of the thirty-five companies with effluent treatment systems, four main methods were used, some in combination with others. These methods were neutralization (twenty-nine cases), clarification/settling (seventeen), reduction of chromic acid with sulfur dioxide or metal bisulphite (sixteen), and chlorination (seven).

Liquid effluent was discharged most frequently to the municipal sanitary sewer, but some companies had discharges to the municipal storm sewer. A few companies discharged directly to the sea, river or ground. Several of the industries had more than one discharge.

In the Lower Mainland there are twenty-seven companies with positive discharges. Ultimately fourteen discharge to the Fraser River; one directly, five via the Lulu Island treatment plant, and eight via the Annacis treatment plant. Eleven discharge to Sturgeon Banks via the Iona treatment plant, one discharges directly to Burrard Inlet, one directly to the Squamish River via the municipal treatment system, and one to the ground.

On Vancouver Island six companies have positive discharges, five in the Victoria area, and one in Nanaimo. All discharge eventually to the sea; four of the companies have direct discharges to the sea, while the rest are via municipal lines.

In the interior there are four companies with positive discharges: one in Prince George, which flows via the municipal sanitary sewer system to the Fraser River, one in Castlegar, which goes via the municipal storm system to the Columbia River, and two which have discharges to the ground.

The overall breakdown according to eventual effluent destination is therefore: 18 discharges to the ocean, 15 to the Fraser River system, one to the Columbia River system, one to the Squamish River system and three to the ground.

Tables 4 and 5 present the liquid effluent treatment and discharge data.

# 4 SPECIAL WASTES

The type of metal finishing operations in use will determine the type of organic wastes produced. Generally, metal forming and heat treating operations generate oil wastes, solvent cleaning operations generate degreasing solvent wastes, and surface coating operations generate paint sludges. Inorganic wastes are produced as sludges in tank bottoms for many of the processes listed, most notaby in electroplating operations.

In the waste section of the survey, questions were asked about oil and solvent wastes, paint sludges and sludges generated from waste water treatment, tank bottoms and spent process solutions. The larger the company, the more likely it was to have wastes in the above-mentioned categories: eighty-eight percent of the large companies, sixty percent of the medium companies and thirty-three percent of the small companies reported wastes. A total of thirty-eight companies generated special waste. Table 6 categorizes disposal methods for the potentially hazardous wastes. Appendix D lists quantities and types of wastes generated as reported on the questionnaire.

## 4.1 Solvent and Oil Wastes

Disposal of organic wastes from metal finishing, if properly done, is a costly alternative compared to reprocessing and reuse. Secondary processing of these wastes produces materials suitable for in-plant reuse, use as fuel, or resale to and reuse by other users.

Waste solvents may be halogenated or non-halogenated, and may contain oil, grease, wax and metallic particles as contaminants. However waste solvents have high potentials for recovery and reuse, and the reclamation technology is well developed. In B.C. services are readily available in the Lower Mainland and on the Island.

Waste oils may be emulsified oils, synthetic oils, or petroleum-based mineral oils, depending on the application. Commonly used additive types include rust preventatives, emulsifiers, anti-oxidants, extreme pressure additives, and viscosity index modifiers. Waste oil may contain such contaminants as metal particles, sediments, sulfur, chlorine,

fluorides, phosphates, phenolic compounds, bio-degradation products and oxidation products. The refinery/reclamation technology for waste oils is also well developed. Services in B.C. are available in Prince George and the Lower Mainland.

Solvent and/or oil wastes were generated by 22 companies, of which 13 companies reported generating oil wastes, and 14 reported generating solvent wastes. A total of thirteen companies recycled these wastes. Nine companies had waste oil picked up for recycle, while eight companies had waste solvent picked up for recycle and one company redistilled its own solvent waste. All of the companies generating both oil and solvent wastes recycled both, with the exception of one company that burned a mixture of oil and solvent waste as fuel. The remainder of the companies disposed of their oil or solvent wastes, usually at a frequency of once per month, although this varied from a weekly to an annual basis. An interesting and unexpected observation was that the small companies had a much better recycling record than the large or medium size companies. All companies that recycled were located in the Lower Mainland with the exception of one in Prince George (oil) and one in Victoria (solvent).

## 4.2 Paint Wastes

Paint wastes vary from innocuous to hazardous, and have limited recovery or reuse potential. As such, paint waste is almost exclusively disposed of, in either sanitary or secured landfills, depending on its composition.

Paint wastes were generated by eleven companies, all medium or large sized. Of these, eight simply disposed of the wastes untreated at sites ranging from the local dump (via garbage collection) to hazardous waste landfill operations in Idaho or Oregon. Only one company reported treating the paint wastes by "neutralizing with additives" prior to disposal. Another company reported treating paint wastes (method unspecified) and then storing the wastes on plant property. One company burned paint wastes.

Paint wastes were disposed of at various frequencies ranging from a daily to an annual basis.

4.3 Additional Sludges

Companies were asked if sludges were generated from waste water treatment processes, tank bottoms or treatment of spent process solutions. Twenty-six companies reported sludges in at least one of these categories.

A total of eleven companies reported sludges being generated from waste water treatment processes. By far the greatest tendency was to simply dispose of these wastes as nine companies did. One company segregated and stored these wastes, while a second stored wastes for evaluation and recycled if possible.

Eighteen companies reported generating tank bottom sludges, although given the number of electroplating companies (20), in addition to other types, this number may be somewhat low. However quite a few mentioned never disposing of anything in the plating tanks. Twelve companies disposed of the tank bottom sludge, two companies stored it, two companies recycled and two more stored and recycled.

Sludges from treatment of spent process solution were generated by three companies. Two companies disposed of these sludges at sites in Oregon and/or Washington. One company dried and segregrated the waste, recycling some of it and storing the rest for future recycling.

Sludges in the waste water treatment, tank bottoms and treatment of spent process solution categories were monitored by only four companies, all classified as being large. If Environment Canada wished to obtain samples of these sludges, good cooperation could be expected since twenty-one of the twenty-six companies said they would agree to give sludge samples.

Only four companies acknowledge storing these wastes on plant property. This is somewhat suprising since usually large and medium size companies have at least some miscellaneous waste (solvent, sludges, oils or mixtures) which are stored pending a decision on how or where to dispose of them. However it appears that the majority of wastes are disposed of, many just through local garbage collection. It may be that some waste is being disposed in this method, that belongs on specially designated sites,

or requires treatment prior to disposal. Since only a few companies monitor the waste sludge, external verification would be required to check this.

Recycling of these specific wastes is practised by only four of twenty-six companies. This option should be encouraged more.

## 4.4 Recovery/Recycling

Companies were asked if recycling/recovery/reclamation is practised in any way. In all twenty-three companies practiced recycling of one form or another. Eleven companies recycled or recovered metals either in solution, sludges, or as scrap. As previously mentioned, nine companies have waste oil picked up for recovery, eight companies have waste solvent picked up and one company recovers waste solvent in plant. Three companies recycle water used in plant processes. Other items recycled or recovered include sand, electrostatic powder paint, acid, and the sludges identified in the previous section. Large and small companies seem to do the most recycling of wastes (59% and 53% respectively) while medium size companies could probably do more (23%). Some of the large and medium size companies mentioned that they are studying the possibility of recycling more and are storing the wastes for future recycling and/or are looking for a recovery process.

# 5 ATMOSPHERIC EMISSIONS

Information on atmospheric emissions was not requested on the survey form, however data relating to fourteen companies was subsequently obtained from regional (Greater Vancouver Regional District) air permits, federal files and site visits. The companies for which information was available are noted in Appendix A and include eleven large size and three medium size companies in the following categories; seven in primary metal products, four in fabricated metal products, two in electroplating services and one transportation equipment. This should not be considered as a representative sample, since the selection is heavily biased towards the large companies which attract more regulatory agency attention. Furthermore the large companies themselves, as previously mentioned, are weighted towards the primary metal products category.

## 5.1 Types of Emissions

Air emissions from surface finishing operations include volatile organic compounds, acid mists, alkaline mists, metals and particulates (dust and grit). The type of process operation being used at a given plant will determine the type of emission. Metal and abrasive dust and grit, for example, are generated during polishing, buffing and deburring. Acid mists are generated from open acid baths such as occur in electroplating, anodizing, etching, pickling and bright dipping operations. Alkaline mists are likewise generated from alkaline cleaning and a few electroplating operations. Volatile organic compounds are produced during painting and solvent cleaning.

The emission data in Table 7 is not representative of the surface finishing industry since very few companies with plating shops are included. The proportion of acid mist, chrome and solvent emissions would be much greater if the whole surface industry was represented.

Appendix C provides more information on emission data for surface finishers in the Greater Vancouver area.

## 5.2 Emission Control Systems

The control of emissions may be approached in three ways, namely substitution of less hazardous chemicals or operations, contaminant dispersion, and treatment or removal of air emissions. The substitution of hazardous solvents by less toxic or non-toxic solvents is the preferred approach and should be practiced where possible. For example, solvent based paints may be replaced by water based paints, and halogenated solvents may be replaced by non-halogenated solvents. Substitutions of this type, if practised, would not be apparent from the sources of information used for this section. Therefore none are reported.

The concentration of air contaminants may be reduced by local exhaust systems. Ventilation hoods or slots are very common in the surface finishing industry as a means of removing emissions over open tanks such as those used in plating, pickling, and solvent or alkaline cleaning operations. Usually these emissions are discharged outside without treatment, but in a few cases, for example where chromic acid is used, a scrubber may be installed in combination with the exhaust system to treat the emissions. Amongst the fourteen companies there were a total of twenty-two exhaust systems.

Other emission control systems frequently used in the surface finishing industry include: cyclones and baghouses, which remove particulates in emissions from grinding, sandblasting, galvanizing or electrostatic paint applications; paint booths (dry or water wash) used in spray painting operations; scrubbers, used to treat emissions from pickling, etching, plating, bright dipping, electroless plating, anodizing and phosphating lines; and mist eliminators, sometimes used in conjunction with scrubbers or local ventilation systems as an after-treatment.

Amongst the thirteen companies there were twenty-five baghouses, ten cyclones, nine scrubbers, four water wash booths, four dry paint booths, three mist eliminators and one filter box. There were no electrostatic precipitators or incinerators in use at these surface finishing companies. One company had no pollution control devices installed.

# 6 CONCLUSIONS

1. Sixty-two surface finishers were identified in the province of British Columbia ranging in size from a few part-time operations to several multi-million dollar industries. The majority of the surface finishing industry is located in the Lower Mainland.

2. On a comparative scale, seventeen companies were classified as being large, thirty as medium and fifteen as being small.

3. The most common industry type was electroplating, in that twenty-nine companies had electroplating shops. The most common process operations were alkaline cleaning, electroplating and solvent cleaning.

4. Thirty-seven companies reported a positive effluent discharge while three companies had closed loop effluent recycling systems. Twenty-two companies stated they had no liquid effluent discharge.

5. Water reduction facilities were widely used amongst companies with liquid effluent and spent process solutions. The most common method for treating spent process solutions was neutralization. The most common treatment methods for liquid effluent included neutralization, clarification/settling, reduction of chromic acid with sulfur dioxide or metal bisulphite, and chlorination. Treatment systems were generally more sophisticated at the larger companies.

6. The majority of the companies discharged to the municipal sanitary sewer system. The overall breakdown according to eventual effluent destination is 18 discharges to the ocean, 15 to the Fraser River system, one to the Columbia River System, one to the Squamish River System and three to the ground.

7. Monitoring of liquid effluent quality had been done at eighty-four percent of the companies with a positive discharge. The monitoring group however varied according to company size. Among the larger industries, regulatory agencies at several levels were interested in monitoring the effluent. Among medium size companies the municipal agencies took the lead in monitoring, while at the small companies very little priority in monitoring was given by the regulatory agencies, such that sampling, if done, was performed by the company.

8. Solvent and/or oil wastes were reported by thirty-five percent of the companies: fifty-nine percent of these recycled waste through oil re-refiners or solvent recovery companies.

9. Paint wastes, having limited potential for recovery, were generally disposed of at sites ranging from the local landfill to special sites in the United States.

10. Wastewater treatment sludges, tank bottom sludges, and/or spent process solution sludges were generated by a total of twenty-six companies. These wastes were generally disposed, although many companies could not identify the site since it was left to a disposal company. Only four companies practised recovery of these sludges. Monitoring of sludges was done by four companies only, all large.

11. Various wastes were recycled or recovered. Large and small companies did quite well in this area, however there appears to be a lot of room for improvement among the medium sized industries.

12. Limited air emissions data was compiled from sources other than the survey, and relates mostly to large companies. Air emissions include particulates, acid mists, alkaline mists, volatile organic compounds and metals such as chrome, lead and zinc.

13. A total of seventy-eight air pollution control systems were in use amongst the fourteen companies for which information was available.

TABLE 1 SURFACE FINISHING INDUSTRY BREAKDOWN

| INDUSTRY TYPE | INDUSTRY SIZE | | | |
|---|---|---|---|---|
| | Large | Medium | Small | Total |
| Plating Services | 1 | 15 | 4 | 20 |
| Fabricated Metal Products | 3 | 7 | 4 | 14 |
| Primary Metal Products | 7 | 2 | 2 | 11 |
| Transportation Equipment and Repair | 4 | 1 | 1 | 6 |
| Specialized Metal Finishing Services (metal cleaning, anodizing, electroplating, heat treating) | - | 4 | 1 | 5 |
| Electrical and Electronic Equipment | 1 | 1 | 1 | 3 |
| Machinery Equipment | 1 | - | 1 | 2 |
| Miscellaneous Products | - | - | 1 | 1 |
| All Types | 17 | 30 | 15 | 62 |

TABLE 2 PROCESS OPERATIONS USED BY SURFACE FINISHING INDUSTRIES

| PROCESS OPERATIONS | LARGE | MEDIUM | SMALL | TOTAL |
|---|---|---|---|---|
| alkaline cleaning | 11 | 19 | 4 | 34 |
| electroplating | 7 | 17 | 5 | 29 |
| solvent cleaning | 12 | 9 | 7 | 28 |
| mechanical deburring, sand blasting | 11 | 10 | 3 | 24 |
| acid pickling | 10 | 9 | 2 | 21 |
| coating (plastic, painting) | 10 | 7 | 3 | 20 |
| stripping electrodeposits | 5 | 12 | 2 | 19 |
| quenching from metal heat treating | 7 | 5 | 2 | 14 |
| chemical conversion coating | 7 | 6 | - | 13 |
| acid bright dripping | 4 | 1 | 1 | 6 |
| anodizing | 3 | 1 | 1 | 5 |
| hot dip galvanizing | 4 | - | - | 4 |
| etching | 2 | - | 1 | 3 |
| cleaning operation from electronic component manufacturing | 1 | 1 | - | 2 |
| electroless plating | 1 | - | - | 1 |
| electropolishing | - | - | 1 | 1 |
| drying operation from electronic component manufacturing | - | 1 | - | 1 |

TABLE 3 LOCATION OF SURFACE FINISHING INDUSTRIES IN B.C.

| MUNICIPALITY | LARGE | MEDIUM | SMALL | TOTAL |
|---|---|---|---|---|
| LOWER MAINLAND | 16 | 21 | 11 | 48 |
| Vancouver | 4 | 9 | 6 | 19 |
| Richmond | 5 | 3 | - | 8 |
| Burnaby | 2 | 2 | - | 4 |
| North Vancouver | 1 | 1 | 2 | 4 |
| Surrey | 3 | - | 1 | 4 |
| Delta | - | 3 | - | 3 |
| New Westminster | - | 1 | 1 | 2 |
| Langley | - | - | 1 | 1 |
| Port Coquitlam | 1 | - | - | 1 |
| Port Moody | - | 1 | - | 1 |
| Squamish | - | 1 | - | 1 |
| VANCOUVER ISLAND | 1 | 3 | 3 | 7 |
| Victoria | - | 3 | 2 | 5 |
| Esquimalt | 1 | - | - | 1 |
| Nanaimo | - | - | 1 | 1 |
| INTERIOR | - | 6 | 1 | 7 |
| Prince George | - | 2 | - | 2 |
| Castlegar | - | 1 | - | 1 |
| Kamloops | - | 1 | - | 1 |
| Kelowna | - | - | 1 | 1 |
| Vernon | - | 1 | - | 1 |
| 100 Mile House | - | 1 | - | 1 |

TABLE 4 LIQUID EFFLUENT - DISCHARGE AND QUALITY DETAILS

| LIQUID EFFLUENT DISCHARGE | LARGE | MEDIUM | SMALL | TOTAL |
|---|---|---|---|---|
| liquid effluent, positive discharge | 11 | 21 | 5 | 37 |
| liquid effluent, closed loop | 2 | 1 | - | 3 |
| no liquid effluent | 4 | 8 | 10 | 22 |
| liquid effluent treated | 10 | 21 | 4 | 35 |
| effluent discharged to: | | | | |
| municipal sanitary sewer | 8 | 14 | 3 | 25 |
| municipal storm sewer | - | 5 | - | 5 |
| industrial sewer | 1 | - | - | 1 |
| sea | 1 | 3 | 1 | 5 |
| fresh water river/stream | 1 | - | - | 1 |
| ground - tile field | - | - | 1 | 1 |
| ground - seepage pit | 1 | 1 | - | 2 |
| other | - | 2 | - | 2 |
| effluent monitored | 11 | 16 | 4 | 31 |
| by company | 9 | 7 | 3 | 19 |
| by regulatory agency - city | 6 | 9 | 1 | 15 |
| - GVRD, WMB, EPS | 4 | 1 | - | 5 |
| numbers supplied | 10 | 5 | 1 | 16 |
| one person responsible for controlled effluent quality and use of treatment equipment | 9 | 11 | 4 | 24 |
| cost of effluent treatment can be estimated | 6 | 5 | 2 | 13 |

TABLE 5 LIQUID EFFLUENT - TREATMENT AND COLLECTION DETAILS

| TREATMENT/COLLECTION | LARGE | MEDIUM | SMALL | TOTAL |
|---|---|---|---|---|
| spent process solutions treated | 12 | 19 | 4 | 35 |
| method: neutralization | 10 | 8 | 2 | 20 |
| reduction | 4 | 1 | - | 5 |
| precipitation/settling/filtration | 1 | 2 | 1 | 4 |
| chlorination | 1 | 1 | - | 2 |
| other | 4 | 1 | 1 | 6 |
| where discharged: offsite | - | 1 | 1 | 2 |
| sewer | 5 | 7 | 1 | 13 |
| effluent treatment | 6 | 15 | 2 | 23 |
| exterior recycle | 2 | 2 | 1 | 5 |
| water reduction facilities | 12 | 16 | 4 | 32 |
| type: spray rinsing | 9 | 9 | 3 | 21 |
| delay over rinse tanks | 8 | 10 | 3 | 21 |
| holding tanks or dams | 9 | 10 | 1 | 20 |
| counterflow rinsing | 9 | 5 | - | 14 |
| minimization of seepage loss | 7 | 6 | 1 | 14 |
| effluent segregation | 9 | 3 | - | 12 |
| conductivity metres | 3 | - | - | 3 |
| minimization dragout/dragout tanks | 1 | - | 2 | 3 |
| other | 2 | 1 | - | 3 |
| liquid effluent collected in trenches or drains | 11 | 14 | 2 | 27 |
| directed to sump and/or tank | 11 | 18 | 3 | 32 |
| liquid effluent treated | 10 | 21 | 4 | 35 |
| method: neutralization | 10 | 16 | 3 | 29 |
| clarification/settling | 6 | 10 | 1 | 17 |
| reduction of chromic acid with sulfur dioxide or metal bisulfite | 5 | 9 | 2 | 16 |
| chlorination | 4 | 3 | - | 7 |
| oil/water separator | - | 1 | - | 1 |
| evaporation | - | - | 1 | 1 |
| cyanide reduction and destruction | 1 | - | - | 1 |
| sludge formed from acid and cleaner wastes, put through a high pressure filter | 1 | - | - | 1 |

TABLE 6 WASTE OIL/SOLVENT/SLUDGE STREAM DISPOSAL

| WASTE | METHOD OF DISPOSAL | | | | | | | | ADDITIONAL COMMENTS |
|---|---|---|---|---|---|---|---|---|---|
| | Recycled | Disposed | Burned | Stored | Stored & Recycled | Treated & Stored | Treated & Disposed | Total Number | |
| oil wastes | 9 | 3 | 1 | - | - | - | - | 13 | - all recycled in Lower Mainland except one in Prince George |
| solvent wastes | 9 | 4 | 1 | - | - | - | - | 14 | - all recycled in Lower Mainland except one in Victoria |
| paint sludges | - | 8 | 1 | - | - | 1 | 1 | 11 | - disposal sites vary from local sanitary to U.S. secure |
| sludges from waste water treatment processes | - | 9 | - | 1 | 1 | - | - | 11 | - in the majority of cases sites were unspecified |
| sludges from tank bottoms | 2 | 12 | - | 2 | 2 | - | - | 18 | - disposal sites unspecified, recycling done for recovery of metals |
| sludges from treatment of spent process solutions | - | 2 | - | - | 1 | - | - | 3 | - disposal sites unspecified |
| TOTALS | 20 | 38 | 3 | 3 | 4 | 1 | 1 | 70 | - from 40 companies |

TABLE 7 RECORD OF AIR EMISSIONS

| EMISSIONS (Process-Related) | NUMBER | SAMPLE AIR EMISSIONS ($mg/m^3$) |
|---|---|---|
| acid mists | 4 | 6.4 - 45.0 |
| alkaline mists | 2 | NA |
| particulates | 11 | 6.9 - 59.3 |
| paint | 3 | NA |
| solvent | 2 | NA |
| chrome | 2 | NA |
| zinc | 4 | 2.3 - 13.7 |
| lead | 1 | NA |
| oil mist | 1 | 11.4 |
| CONTROL DEVICES IN USE | NUMBER | |
| baghouse | 25 | |
| ventilation system | 22 | |
| cyclone | 10 | |
| scrubber | 9 | |
| water wash booth | 4 | |
| dry paint booth | 4 | |
| mist eliminator | 3 | |
| filter box | 1 | |
| total | 78 | |

## BIBILIOGRAPHY

1. Cheng, S.C., Alternative Treatment of Organic Solvents and Sludges from Metal Finishing Operations. Cincinnati: U.S. Environmental Protection Agency, September 1983 (EPA-600/2-83-094).

2. Environment Canada, and J.E. Hanna Associates Inc., Overview Assessment of the Canadian Surface Finishing Industry, March 1985 draft.

3. Graham, A.K. Ed., Electroplating Engineering Handbook, 3rd ed. New York: Van Nostrand Reinhold Company, 1971.

## APPENDIX A

LIST OF SURFACE FINISHING COMPANIES
IN BRITISH COLUMBIA

APPENDIX A - List of Metal Finishing Industries in British Columbia

| NAME | ADDRESS | DISCHARGE TO |
|---|---|---|
| **Electroplating Services** | | |
| Dependable Plating Ltd. | 3857 E 1st Avenue, Burnaby, V5C 3V6 | municipal sanitary (Iona) |
| Interior Armour Plating Ltd. | 920 Columbia Avenue, Castlegar, V1N 1H2 | municipal storm (Columbia River) |
| Shield Electroplating Inc. | 201 - 7641 Vantage Way, Delta, V4G 1A6 | municipal sanitary (Annacis) |
| PRO Diesel, Chrome & Hydraulics | 969A Laval Crescent, Kamloops V2C 5P4 | no discharge |
| All-Brite Plating | 28-2789 Hwy 97 N. Kelowna V1X 4J8 | ground |
| West Coast Chrome Inc. | 4364 Wellington Road, Nanaimo V9T 2H3 | municipal sanitary |
| Specialty Plating Co. Ltd. | 2108 Front St, North Vancouver V7H 1A3 | to sea (Burrard Inlet) |
| Dynasurf Western Ltd. | Box 2009, Prince George V2N 2G6 | no discharge |
| Industrial Chrome Ltd. | 844-4th Ave. Prince George V2L 3H6 | municipal sanitary (Fraser River) |
| Kal Chrome Ltd. | 13451C Vulcan Way, Richmond V6V 1K4 | municipal sanitary (Lulu) |
| Wenger Electroplating | 3653 Nico-Wynd Drive, Surrey V4A 5Z4 | no discharge |
| Acme Plating & Silver Shop Ltd. | 1530 West 6th Avenue, Vancouver V6J 1R2 | no discharge |
| Columbia Chrome Industries Ltd. | 1446 Clark Drive, Vancouver V5L 3K8 | municipal sanitary (Iona) |
| *Hudson Plating Company Ltd. | 275 West 5th Avenue, Vancouver V5Y 1J3 | municipal sanitary (Iona) |
| *Modern Hardchrome Ltd. | 1519 E. Pender Street, Vancouver V5L 1V9 | municipal sanitary (Iona) |
| Pacific Plating Ltd. | 1226 Frances Street, Vancouver V6A 1Z5 | municipal sanitary (Iona) |
| Precision Engineering (Chroming) Ltd. | 1975 McLean Drive, Vancouver V5N 3J7 | municipal sanitary (Iona) |
| Comet Plating Co. Ltd. | 334 Hillside Avenue, Victoria V8T 1Y5 | municipal storm, & sea |
| Jeffries & Co. Silversmiths Ltd. | 1026 Fort Street, Victoria V8V 3K4 | to sea |
| Victoria Plating Ltd. | 892 Devonshire Road, Victoria V9A 4T6 | municipal storm, & sea |

* Companies reviewed for the emissions section

**APPENDIX A - List of Metal Finishing Industries in British Columbia** (Cont'd.)

| NAME | ADDRESS | DISCHARGE TO |
|---|---|---|
| **Fabricated Metal Products** | | |
| *Johnson & Neven Ltd. | 5577 Byrne Street, Burnaby V5J 3J2 | no discharge |
| *Weiser Inc. | 6700 Beresford Street, Burnaby V5E 1Y2 | municipal sanitary (Iona) |
| *Ebco Industries Ltd. | 7851 Alderbridge Way, Richmond V6X 2A4 | muncipal sanitary (Lulu) |
| Fraser Fasteners Ltd. | 12120 Bridgeport Rd, Richmond V6V 1J3 | no discharge |
| Lister Bolt & Chain Ltd. | 1771 Savage Road, Richmond V6V 1R1 | municipal system (Lulu) |
| A.W. Screw Machine Products Ltd. | 1836 Franklin Street, Vancouver V5L 1P8 | no discharge |
| *Canron Inc. | 145 West 1st Avenue, Vancouver V5Y 1A2 | no discharge (recycle) |
| Dendoff Springs Ltd. | 345 1st Avenue, Vancouver V5T 1A7 | no discharge |
| Metal & Wood Products (1958) Ltd. | 43 East 3rd Avenue, Vancouver V5T 1C5 | no discharge |
| McAllister Spring Ltd. | 425 West 6th Avenue, Vancouver V5Y 1L3 | no discharge |
| Parry Dial & Nameplate | 6562 Doman Street, Vancouver V5S 3H4 | no discharge |
| Pressed Metal Products Ltd. | 505 Alexander Street, Vancouver V6A 1C8 | municipal sanitary (Iona) |
| Smith Bros. Foundry & Machine Works | 632 Pembroke Street, Victoria V8T 1H6 | no discharge |
| Cariboo Sheet Metal Ltd. | P.O. Box 1330, 100 Mile House V0K 2E0 | ground (seepage pit) |
| **Primary Metal Products** | | |
| Globe Foundry Ltd. | 7647 Willard Street, New Westminster V3N 2W2 | no discharge |
| *Noranda Metal Industries Ltd. | 920 Derwent Way, New Westminster V3M 5R2 | no discharge |
| *Esco Ltd. | 1855 Kingsway Avenue, Pt. Coquitlam V3C 1T1 | no discharge (recycle) |
| *Alcan Canada Products Ltd. | 12600 Vulcan Way, Richmond V6V 1K1 | municipal industrial (Lulu) |
| *Tree Island Steel Co. Ltd. | 3933 Boundary Road, Richmond V6V 1T8 | Fraser River & ground |

* Companies reviewed for the emissions section

APPENDIX A - List of Metal Finishing Industries in British Columbia (Cont'd.)

| NAME | ADDRESS | DISCHARGE TO |
|---|---|---|
| **Primary Metal Products (Cont'd.)** | | |
| *Highland Foundry Ltd. | 9670 - 187 Street, Surrey V3T 4W2 | no discharge |
| *Robar Industries Ltd. | 12945 - 78th Avenue, Surrey V3W 2X8 | municipal sanitary (Annacis) |
| *Titan Steel & Wire Co. Ltd. | 11041 Elevator Road, Surrey V3V 2R8 | municipal sanitary (Annacis) |
| Advance Foundry Ltd. | 236 Clark Drive, Vancouver V5L 3H3 | no discharge |
| Wire Rope Industries | 3185 Grandview Highway, Vancouver V5M 2G1 | no discharge |
| Alcan Pipe | Box 757, Vernon V1T 6M7 | no discharge (recycle) |
| **Transportation Equipment and Repair** | | |
| *DND Ship Repair Unit | CFB, Esquimalt, FMO, Victoria | to sea |
| Thunderbolt Engines Inc. | 5880 - 200A Street, Langley V3A 5X8 | municipal sanitary (Annacis) |
| Bel-Aire Shipyard Ltd. | 1667 Columbia Street, North Vancouver V7J 1A5 | no discharge |
| Canadian Aircraft Products Ltd. | 2611 Viscount Way, Richmond V6V 1M9 | municipal sanitary (Lulu) |
| British Columbia Railway | Box 190, Squamish VON 3GO | municipal sanitary (Squamish R.) |
| Canadian Pacific Airlines Ltd. | One, Grant McConachie Way, Vancouver Int. Airport | municipal sanitary (Iona) |
| **Specialized Metal Finishing Services** | | |
| Redi-Strip Metal Cleaning Canada Ltd. | 7761 Vantage Way, Tilbury Island, Delta V4G 1A6 | municipal sanitary (Annacis) |
| Chilco Electropolishing | 1449 Charlotte Street, North Vancouver V7J 1H1 | no discharge |
| Surf-Tech Industries Ltd. | 2613 Murray Street, Port Moody V3H 1X1 | municipal sanitary (Annacis) |
| McLeod & Norquay Ltd. | 520 Raymur Avenue, Vancouver V6A 3L2 | municipal storm (Iona) |
| Redi-Strip (Victoria) Ltd. | 1496 Admirals Road, Victoria V9A 2R1 | municipal sanitary |

* Companies reviewed for the emissions section

APPENDIX A - List of Metal Finishing Industries in British Columbia (Cont'd.)

| NAME | ADDRESS | DISCHARGE TO |
|---|---|---|
| **Electrical and Electronic Equipment** | | |
| Circuit Graphics Ltd. | 8030 Winston Street, Burnaby V5A 2H5 | municipal sanitary (Annacis) |
| Elite Lighting Inc. | 8003 Webster Road, Delta V4G 1E4 | municipal sanitary (Annacis) |
| Viscount Industries Ltd. | 105E - 69th Avenue, Vancouver V5X 2W9 | no discharge |
| **Machinery Equipment** | | |
| Lynn Buckets Ltd. | 1593 Barrow Street, North Vancouver V7J 1B7 | no discharge |
| Westcan Engineering & Machine Ltd. | 707 West 7th Avenue, Vancouver V5Z 1B7 | no discharge |
| **Miscellaneous Products** | | |
| Imperial Record Corporation Ltd. | 8849 Selkirk Street, Vancouver V6P 4J6 | municipal sanitary (Iona) |

## APPENDIX B

QUESTIONNAIRE USED IN THE SURVEY

ENVIRONMENT CANADA

ENVIRONMENTAL PROTECTION SERVICE

SURFACE FINISHING INDUSTRY REVIEW

COMPANY NAME _____

SITE ADDRESS _____

_____

POSTAL CODE _____

MAILING ADDRESS (IF DIFFERENT FROM ABOVE)

_____

POSTAL CODE _____

PHONE NUMBER _____

DATE _____

NAME AND POSITION OF PERSON FILLING OUT FORM

_____

_____

DO YOU HAVE ANY SURFACE FINISHING OPERATIONS IN YOUR PLANT SUCH AS PLATING, ANODIZING, METAL HEAT TREATING, OR COATING (NOT INCLUDING PLASTIC COATING OR PAINT COATING OPERATIONS)?

YES _____ NO _____

GENERAL

1. How many years has the business been operating? _____

2. Normal working days per year _____
   Normal shifts per day _____

3. Number of employees presently in finishing operations _____

4. Which of the following surface finishing operations are employed? (check one or more below)
   (a) Mechanical deburring, sand blasting _____

   (b) Hot dip galvanizing (coating a metallic workpiece with another metal by immersion in a molten bath to provide a protective film) _____
   - aluminum _____
   - zinc _____
   - lead _____
   - tin _____

   (c) Electroplating (production of a thin surface coating of one metal on another by electro-deposition. Metal ions in either acidic or alkaline or neutral solutions are reduced on cathodic surfaces).

| | | |
|---|---|---|
| Nickel plating | bright | _____ |
| | semi-bright | _____ |
| | acid | _____ |
| | black | _____ |
| Chromium plating | acidic | _____ |
| | alkaline | _____ |
| Copper plating | cyanide | _____ |
| | pyrophosphate | _____ |
| | sulphate | _____ |
| Zinc plating | cyanide | _____ |
| | chloride | _____ |
| | sulphate | _____ |
| Brass plating | | _____ |
| Tin plating | chloride | _____ |
| | acid | _____ |
| | alkaline | _____ |
| Cadmium plating | cyanide | _____ |
| | acid | _____ |

Gold plating _____
Silver plating _____
Lead plating _____
Iron plating _____
Other (please specify) _____

(d) Electroless plating (chemical reduction process which depends on the catalytic reduction of a metallic ion in an aqueous solution containing a reduction agent and the subsequent deposition of metal without the use of external electrical energy).

| | | |
|---|---|---|
| Copper | | _____ |
| Nickel | | _____ |
| Brass | | _____ |
| Tin | chloride | _____ |
| | alkaline | _____ |
| Iron | | _____ |
| Chromium | acid | _____ |
| | alkaline | _____ |
| Cadmium | | _____ |
| Gold | cyanide | _____ |
| | chloride | _____ |
| Silver | | _____ |

Other (please specify) _____

(e) Anodizing aluminum or magnesium (electrolytic oxidation process which converts the surface of a metal to an insoluble oxide)

sulphuric _____
chromic _____

(f) Solvent cleaning (process of removing oils and grease from surface of workpiece by the use of organic solvents) NB - A halogenated solvent is one which is combined with one or more of the following: fluorine, chlorine, bromine or iodine.

vapor - halogenated solvents _____
- non-halogenated solvents _____
liquid - halogenated solvents _____
- non-halogenated solvents _____

(g) Alkaline cleaning (removal of oily dirt or solid soils. Detergent nature of cleaning solution provides most of the cleaning action with agitation of work piece secondary) _____

(h) Acid pickling (a solution of an inorganic mineral acid, organic acid or acid salt in combination with a wetting agent or detergent to remove dirt, oil and oxide from metal surfaces) _____

(i) Acid bright dipping (a specialized form of etching (k) used to remove oxide and tarnish from ferrous and non-ferrous materials) _____

(j) Stripping Electrodeposits

electrolytically _____
immersion only _____

(k) Etching (production of specific design configurations and tolerances on parts (a metal clad plastic in the case of p.c.b.'s) by controlled dissolution of the metal with chemical reagents of etchants)

alkaline _____
acid (specify type used) _____

(l) Chemical conversion coating (coatings are applied to previously deposited metal or base metal)

Chromating or passivating — chromic acid _____
other _____

Metal coloring _____

Phosphate (immersion in dilute solution of phosphoric acid) _____

(m) Coating

plastic _____
painting _____
electrostatic painting _____

(n) Electropolishing (process of smoothing or enhancing a metal surface by making it an anode in a suitable electrolyte) _____

(o) Salt bath pot cleaning from metal heat treating operations _____

(p) Quenching from metal heat treating operations

brine solutions _____
water and water-based solutions _____

(q) Cyaniding from metal heat treating operations _____

(r) Drying operations from electronic components manufacturing

- halogenated solvent _____
- non-halogenated solvent _____

(s) Making, forming and coating operations from electronic components manufacturing

- halogenated solvent _____
- non-halogenated solvent _____

(t) Cleaning operations from electronic components manufacturing

cyanides _____
acid _____
alkali _____

5. If the information is not considered proprietary, approximately what is your total output of surface finished products per year? ($/year)

_____

6. What are the major products manufactured at the plant? (printed circuit board, plated screws, hardened metal products, etc.)

_____

7. Are spent process solutions treated before discharge?

Yes _____ No _____

Method used (if any) _____

8. Where are spent process solutions discharged?

offsite _____
sewer _____
effluent treatment _____
Other _____

9. Are there any water reduction facilities procedures in the plant (for example see below)? Specify. Yes _____ No _____

- counterflow rinsing _____
- conductivity meters in rinse tanks _____
- effluent segregation with trenching and piping _____
- delay over rinse tanks (manually or by relays) to reduce dragout _____
- spray rinsing _____
- holding tanks or dams to catch accidental spills _____
- minimization of seepage losses through floors (by timely maintenance, crack repair, etc.) _____
- Other (specify) _____

10. Are liquid effluents collected in trenches or drains?

Yes _____ No _____

Directed to a common collection facility? Yes _____ No _____

(Sump or tank) Specify _____

11. Are liquid effluents treated? Yes _____ No _____

Method used (if any):

- chemical treatment (give details)
  - chlorination _____
  - reduction of chromic acid with sulphur dioxide or metal bisulphite _____
  - neutralization of acid or alkali _____
  - Other (specify) _____

- separation or destruction (give details)
  - clarification/gravity settling _____
  - electrolytic destruction _____
  - reverse osmosis _____
  - electrodialysis _____
  - high pressure temperature hydrolysis _____
  - ion exchange _____
  - Other (specify) _____

- evaporation _____
- other (specify) _____

12. Where does the effluent from the system flow?

- to municipal sanitary system _____
- to municipal storm system _____
- to water
  - sea _____
  - lake _____
  - river/stream
    - fresh _____
    - tidal _____
- to ground
  - tile field _____
  - deep well _____
  - seepage pit _____
  - surface _____
- other (specify) _____

13. Is effluent quantity and quality normally monitored?
Yes _____ No _____

EFFLUENT QUALITY

- if yes by whom?
  - the company _____
  - an environmental agency _____
- if possible, supply the following:

| | | |
|---|---|---|
| flow rate | _____ | |
| pH | _____ | |
| suspended solids | _____ | ppm |
| chromium | _____ | " |
| cadmium | _____ | " |
| copper | _____ | " |
| nickel | _____ | " |
| lead | _____ | " |
| zinc | _____ | " |
| cyanide | _____ | " |

14. Is one person responsible for controlling effluent quality and use of treatment equipment (if applicable)? Yes _____ No _____

15. Can you estimate annual cost of compliance with control requirements?
Yes _____ No _____

HAZARDOUS WASTES

16. Are solvent or oil wastes generated from processing? (degreasing, machining, heat treating, forming, plastic thermo forming)
Yes _____ No _____ (1) Volume (l or $m^3$) _____
(2) Frequency of Disposal (daily/weekly/monthly) _____

(If yes specify items (1), (2)) Specify the operation _____
_____

17. Are paint sludges generated from processing? (stripping, coating)
Yes _____ No _____ (1) Volume (l or $m^3$) _____
(2) Frequency of Disposal (daily/weekly/monthly) _____

18. Are these wastes segregated? Yes _____ No _____
treated? (specify method) _____ Yes _____ No _____
recovered? (specify method) _____ Yes _____ No _____
disposed? (specify method) _____ Yes _____ No _____
Other (specify) _____ Yes _____ No _____
If wastes are disposed, please specify site _____

19. Are any sludges generated from waste water treatment processes?
Yes _____ No _____

(If yes specify items (1), (2), (3))
(1) Volume (l or $m^3$) _____
(2) Dry Content Before Disposal (%) _____
(3) Frequency of Disposal (daily/weekly/monthly) _____

from tank bottoms? Yes _____ No _____
(1) Volume (l or $m^3$) _____
(2) Dry Content Before Disposal (%) _____
(3) Frequency of Disposal (daily/weekly/monthly) _____

from treatment of spent process solutions? (specify)
Yes _____ No _____
(1) Volume (l or $m^3$) _____
(2) Dry Content Before Disposal (%) _____
(3) Frequency of Disposal (daily/weekly/monthly) _____

20. Are these sludges segregated? Yes _____ No _____
treated? (specify method) _____ Yes _____ No _____
recovered? (specify method) _____ Yes _____ No _____
disposed? (specify method) _____ Yes _____ No _____
Other (specify) _____ Yes _____ No _____
If sludges are disposed, please specify site _____

21. Are the sludges monitored? Yes _____ No _____
If yes, specify content:

| | |
|---|---|
| chromium | _____ ppm |
| cadmium | _____ " |
| copper | _____ " |
| nickel | _____ " |
| lead | _____ " |
| zinc | _____ " |
| cyanides | _____ " |
| solvents | _____ |

If no, would you agree to give us a sample? Yes _____ No _____

22. Are any materials reclaimed/regenerated or recovered in any way?
Yes _____ No _____
Specify _____

SPECIFY ITEMS (1), (2) FOR EACH OPERATION IDENTIFIED IN QUESTION #4

| Specific Operation | Process Solution (1) Total Capacity (Vol) of Tanks (litres or cubic metres) | Process Solution (2) Frequency of Disposal (when spent) (weekly/monthly) |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

Please indicate quantities of solvents and heavy metals used (purchased) during 1983. If more readily available 1982 figures may be used; please identify them as 1982 figures and explain by what percent 1983 figures differ (e.g. 1983 figures are roughly 15% higher than 1982).

| | quantity (kg) 1983 |
|---|---|
| chromium | |
| cadmium | |
| copper | |
| nickel | |
| lead | |
| zinc | |
| cyanide | |
| halogenated solvents (specify) | |
| | |
| | |
| | |
| non-halogenated solvents (specify) | |
| | |
| | |
| | |

# APPENDIX C

## OVERVIEW OF EMISSIONS DATA FOR THE SURFACE FINISHING INDUSTRY IN BRITISH COLUMBIA

By

Paul D. Ross

September, 1985

# EMISSIONS FROM THE BRITISH COLUMBIA SURFACE FINISHING INDUSTRY

## OVERVIEW

There are an estimated seventy to seventy-five surface finishers in British Columbia. Of the sixty-two surface finishers who completed and returned the effluent survey questionnaire, twelve (or 19%) were found to have air emissions permits (see Table 1). Stack sampling results were available for eight of the twelve permittees, which corresponds to 13% of the surface finishers who participated in the survey.

The emissions data is not representative of the industry as a whole. The monitored companies were large operations (six) and medium sized (two). All eight were located within the Lower Mainland. Some emissions data was available for five companies producing primary metal products, two companies producing fabricated metal products, and one electroplater.

The stack sampling results given within this document were obtained from the Greater Vancouver Regional District (GVRD) office files and are considered proprietary knowledge. Some monitoring data was available for the following contaminants: particulate matter, zinc, chromium sulphate, sulphuric acid, hydrochloric acid, and oil mist. Most contaminant parameters were only sampled at a single location, with the exceptions of particulate matter and zinc, which were monitored at seven companies and three companies, respectively. All sampling was conducted between 1975 and 1985.

There are no specific provincial regulations for atmospheric emissions for the surface finishing industry in B.C. Ambient air quality objectives of interest to surface finishers are given in Table 2.

The lack of monitoring data does not allow for any type of quantitative analysis of emissions from the surface finishing industry of B.C. However, where possible, stack sampling results have been compared with permitted levels. Results are given below. While these results are certainly not representative of the industry as a whole, they give an indication of some companies' emissions relative to their permitted discharges.

## EMISSION CONTROL TECHNOLOGY

Emission control devices were utilized by eleven of the twelve companies with permits; all eight companies that were monitored used air pollution control equipment. Particulate matter emissions were controlled by one or more baghouses at six (of twelve) companies and by three or more cyclones at two companies. One of these companies also used its baghouse to limit zinc emissions. Two companies each employed a scrubber to reduce atmospheric emissions of chromium sulphate, and hydrochloric acid respectively.

The monitoring data is too limited to afford any statistically significant analysis. However, it may be noted that point source emissions with emission control devices discharged at a rate less than 15% of their allowable level 89% of the time.

TABLE 1 SURFACE FINISHERS WITH EMISSIONS PERMITS

| COMPANY | LOCATION | OPERATION SIZE | OPERATION CATEGORY* | SAMPLING CONDUCTED |
|---|---|---|---|---|
| Alcan Canada Products Ltd. | Richmond | Large | 1 | No |
| Canron Inc. | Vancouver | Large | 2 | Yes |
| Ebco Industries Ltd. | Richmond | Large | 2 | No |
| Esco Ltd. | Port Coquitlam | Large | 1 | Yes |
| Highland Foundry Ltd. | Surrey | Large | 1 | Yes |
| Johnson and Neven Ltd. | Burnaby | Medium | 2 | No |
| Modern Hardchrome Ltd. | Vancouver | Medium | 3 | Yes |
| Noranda Metal Industries Ltd. | New Westminster | Medium | 1 | Yes |
| Robar Industries Ltd. | Surrey | Large | 1 | No |
| Titan Steel & Wire Co. Ltd. | Surrey | Large | 1 | Yes |
| Tree Island Steel Co. Ltd. | Richmond | Large | 1 | Yes |
| Weiser Inc. | Burnaby | Large | 2 | Yes |

* Operation Category Key:

1 - Primary Metal Products
2 - Fabricated Metal Products
3 - Electorplaing Services

TABLE 2 B.C. AIR QUALITY GUIDELINES AND OBJECTIVES

| AIR CONTAMINANT | TIME BASE | UNITS | DESIRABLE LEVEL | INTERIM LEVEL | MAXIMUM LEVEL |
|---|---|---|---|---|---|
| Suspended Particulate Matter (Total) | 24 hour | $ug/m^3$ | 150 | 200 | - |
| | 1 year geometric mean | $ug/m^3$ | 60 | 70 | - |
| Lead | 24 hour | $ug/m^3$ | 4 | 4 | 6 |
| | 1 year geometric mean | $ug/m^3$ | 2 | 2 | 3 |
| Zinc | 24 hour | $ug/m^3$ | 5 | 5 | 8 |
| | 1 year geometric mean | $ug/m^3$ | 3 | 3 | 4 |

## ZINC EMISSIONS

Zinc emissions data was available for three companies. Sampling was conducted at the following discharges: a roof vent associated with a large zinc kettle in the galvanizing shop; a baghouse associated with a nail galvanizing operation; and a zinc die cast stack. Results are summarized in Table 3.

TABLE 3 ZINC MONITORING RESULTS

| SOURCE | DATE | CONTROL DEVICE | PERMITTED LEVEL | ACTUAL EMISSION | % OF PERMIT LEVEL |
|---|---|---|---|---|---|
| Zinc Kettle | Aug/83 | No | 7 $mg/m^3$ | 2.2 $mg/m^3$ | 31% |
| Zinc Kettle | May/80 | No | 7 $mg/m^3$ | 0.1 $mg/m^3$ | 2% |
| Nail Galvanizing | July/81 | Baghouse | 7 $mg/m^3$ | undetectable | < 1% |
| Zinc Die Cast | Apr/77 | No | 7 $mg/m^3$ | 1.4 $mg/m^3$ | 20% |

## SULPHURIC ACID EMISSIONS

Sulphuric acid emissions data was available for one company. Sampling was conducted at a roof vent associated with acid pickling tanks in a galvanizing shop. Results are summarized in Table 4.

TABLE 4 SULPHURIC ACID MONITORING RESULTS

| SOURCE | DATE | CONTROL DEVICE | PERMITTED LEVEL | ACTUAL EMISSION | % OF PERMIT LEVEL |
|---|---|---|---|---|---|
| Acid Pickling Tanks | May/80 | No | 50 $mg/m^3$ | < 0.04 $mg/m^3$ | < 0.1% |

## HYDROCHLORIC ACID EMISSIONS

Hydrochloric acid emissions data was available for one company. Sampling was conducted at the stack following the scrubber associated with muriatic (hydrochloric) acid tanks.

TABLE 5 HYDROCHLORIC ACID MONITORING RESULTS

| SOURCE | DATE | CONTROL DEVICE | PERMITTED LEVEL | ACTUAL EMISSION | % OF PERMIT LEVEL |
|---|---|---|---|---|---|
| Muriatic Acid Tanks | June/84 | Scrubber | 70.0 $mg/m^3$ | 33.4 $mg/m^3$ | 48% |
| Muriatic Acid Tanks | July/81 | Scrubber | 70.0 $mg/m^3$ | 8.3 $mg/m^3$ | 12% |
| Muriatic Acid Tanks | Jan/81 | Scrubber | 70.0 $mg/m^3$ | 90.2 $mg/m^3$ | 129% |

## CHROMIUM SULPHATE EMISSIONS

Chromium sulphate emissions data was available for one company. Sampling was conducted at the discharge of a chromic acid scrubber associated with three chromium plating tanks. Results are summarized in Table 5.

TABLE 6 CHROMIUM SULPHATE MONITORING RESULTS

| SOURCE | DATE | CONTROL DEVICE | PERMITTED LEVEL | ACTUAL EMISSION | % OF PERMIT LEVEL |
|---|---|---|---|---|---|
| Chromic Acid Scrubber | May/80 | Scrubber | 25 $mg/m^3$ | 0.7 $mg/m^3$ | 3% |
| Chromic Acid Scrubber | Apr/79 | Scrubber | 25 $mg/m^3$ | 0.9 $mg/m^3$ | 4% |

PARTICULATE MATTER EMISSIONS

Particulate emissions data was available for six companies. Sampling was conducted at the following discharges: a roof vent associated with a zinc kettle; a baghouse associated with an arc furnace; a baghouse associated with a shake out system; a stack associated with a furnace pour exhaust fan and stack associated with a furnace cover exhaust fan; a baghouse associated with nail galvanizing; a cyclone exhaust associated with polishing machines. Results are summarized in Table 7.

TABLE 7 PARTICULATE MATTER MONITORING RESULTS

| SOURCE | DATE | CONTROL DEVICE | PERMITTED LEVEL | ACTUAL EMISSION | % OF PERMIT LEVEL |
|---|---|---|---|---|---|
| Zinc Kettle | Aug/83 | No | 230 $mg/m^3$ | 11.4 $mg/m^3$ | 5% |
| Zinc Kettle | May/80 | No | 230 $mg/m^3$ | 4.6 $mg/m^3$ | 2% |
| Arc Furnace | Apr/85 | Baghouse | 50 $mg/m^3$ | 18.4 $mg/m^3$ | 37% |
| Arc Furnace | Apr/77 | Baghouse | 50 $mg/m^3$ | 1.0 $mg/m^3$ | 1% |
| Shake Out System | Apr/80 | Baghouse | 50 $mg/m^3$ | 0.0 $mg/m^3$ | 0% |
| Furnace Pour Exhaust | Jul/84 | No | 45 $mg/m^3$ | 49.3 $mg/m^3$ | 110% |

CONTINUED...

TABLE 7 PARTICULATE MATTER MONITORING RESULTS

(Continued)

| SOURCE | DATE | CONTROL DEVICE | PERMITTED LEVEL | ACTUAL EMISSION | % OF PERMIT LEVEL |
|---|---|---|---|---|---|
| Furnace Cover Exhaust | Jul/84 | No | 45 $mg/m^3$ | 27.5 $mg/m^3$ | 60% |
| Nail Galvanizing | Jul/81 | Baghouse | 230 $mg/m^3$ | undetectable | 0% |
| Nail Galvanizing | Jun/85 | Baghouse | 230 $mg/m^3$ | 22.9 $mg/m^3$ | 10% |
| Polishing Machines | Apr/77 | Cyclone | 120 $mg/m^3$ | 17.0 $mg/m^3$ | 14% |

OIL MIST EMISSIONS

Oil mist emissions data was available for one company. Sampling was conducted at the discharge of the core oven vent. Results are summarized in Table 8.

TABLE 8 OIL MIST MONITORING RESULTS

| SOURCE | DATE | CONTROL DEVICE | PERMITTED LEVEL | ACTUAL EMISSION | % OF PERMIT LEVEL |
|---|---|---|---|---|---|
| Core Oven | May/75 | No | no odour past plant boundary, opacity up to 20% | 11.4 $mg/m^3$ | - |

SUMMARY

Stack sampling results were available for only eight of sixty-two companies previously identified as surface finishers in British Columbia. Contaminants of particulates, zinc, hydrochloric acid, sulphuric acid, chromium sulphate, and oil mist were monitored, usually at only one location. All eight companies employed at least one emission control device.

The current data base is too small to develop base-line emissions, or emission factors for the surface finishing industry in B.C. Monitoring results are most likely not representative of the industry as a whole. The companies for which monitoring results were available generally discharged atmospheric emissions at levels well below those stipulated on their permits.

## APPENDIX D

LIST OF WASTE GENERATED BY
THE SURFACE FINISHING INDUSTRY

LIST OF WASTE GENERATED BY SURFACE FINISHING INDUSTRY,
AS REPORTED ON QUESTIONNAIRE

| QUANTITY | UNIT | DESCRIPTION |
|---|---|---|
| 455 | litres/month | solvent |
| 100 | litres/month | solvent |
| 45000 | litres/year | solvent |
| 200 | gallons/year | solvent |
| 200 | litres/year | solvent |
| 1 | cubic meter/month | solvent |
| 5 | gallons/year | solvent |
| 5000 | litres/year | oil and solvent |
| 5 | litres/week | oil |
| 2000 | litres/month | oil |
| 5 | litres/year | oil |
| 330 | gallons/year | oil |
| 500 | litres/month | oil |
| 1200 | litres/year | paint |
| 200 | gallons/year | paint |
| 500 | litres/month | paint |
| 1000 | litres/year | paint |
| 17.5 | cubic meters/year | sludge (2% dry) |
| 400 | litres/year | sludge (90% dry) |
| 1000 | litres/year | sludge (90% dry) |
| 100 | pounds/year | sludge |
| 150 | gallons/2 years | sludge |
| 1 | tank truck load/5-10 years | sludge |
| 150 | gallons/year | sludge (85% dry) |
| 400 | gallons/year | sludge (85% dry) |
| 200 | litres/year | sludge (15% dry) |
| 1 | cubic meter/year | sludge |
| 1360 | litres/year | sludge (flux tank) |
| 1360 | litres/year | sludge (alkali tank) |
| 5 | litres/year | sludge (30% dry) |
| 500 | litres/year | sludge |
| 1 | cubic meter/5 years | sludge |
| 500 | litres/year | sludge |
| 5 | gallons/8 years | sludge (10% dry) |
| 2 | cubic feet/month | sludge |
| 280 | cubic meters/year | sludge (60% dry) |
| 73 | cubic meters/year | sludge (50% dry) |
| 4000 | litres/year | sludge (25% dry) |
| 2 | cubic meters/month | dry scale from quench tank |